TOTAL PRODUCTIVE MAINTENANCE, KAIZEN EVENT, INNOVATION PERFORMANCE IN MALAYSIAN AUTOMOTIVE INDUSTRY

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ABSTRACT

Manufacturing processes must be implemented optimally to remain competitive in the current economic environment. The manufacturing process involves the maintenance of equipment and this is known as Total Productive Maintenance (TPM). TPM practices will impact on Innovation Performance (IP). The relationship between IP with TPM practice will be more effective if supported by other practices such as Kaizen Event (KE). The purpose of this paper is to identify the TPM and KE constructs to innovation performance measures for Malaysian automotive industry and also to develop research model of the TPM, KE and, IP measures relationship for Malaysian automotive industry. A conceptual model based on previous studies has been proposed. This model will be used to study the structural relationship between TPM, KE practices and IP for Malaysian automotive industry. Based on the proposed conceptual model and reviewed, research hypotheses are being developed. The paper culminates with suggested future research work.

Keywords— Total productive maintenance, Kaizen event, Innovation performance, SEM

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1. INTRODUCTION

Recently, the global environment is changing faster, competition between organizations is increasing especially for manufacturing organizations (Miyake and Enkawa, 1999). Automotive industry involves a big change in the management approach, product and technology process approach, customer needs, and supplier attitudes. Maintenance function as reducing expenditure on the purchase of new equipment, it helps organizations to reduce investment on new equipment (Patterson *et al.*, 1996). The lack of the maintenance practices in the past, have adversely affected the organizational competitiveness by reducing throughput and reliability of production facilities. This has effect to production facilities, lowering equipment availability due to excessive system downtime, lowering production quality, increasing inventory, thereby leading to unreliable delivery performance. As organizations in today's highly challenging scenario have moved to reduce costs and improve quality and responsiveness, the reduction in inventory and excess capacity have revealed serious weaknesses in the traditional maintenance programs (Lawrence, 1999).

Total Productive Maintenance (TPM) is the best management system to be implemented, and it fits with the organization's goals to reduce costs, improve inventory and company performance (Ahuja and Khamba, 2008) When confronted with competition challenges in the market, manufacturing organizations need to improve the quality and enhance the maintenance improvements performance in various aspects of their operations (Pintelon*et al.*, 2006). Outstanding achievements in maintenance issues will make the organization achieve World Class Manufacturing (WCM) (Brah and Chong, 2004). The current trend makes the top competition strive for the utilization in the use of equipment, increase productivity, maximum utilization of resources, improve the quality and conscious with maintenance system with the goal to achieving WCM status (Garg and Deshmukh, 2006).

To assist TPM in achieving WCM, Kaizen Event (KE) practice can be implemented concurrently with the TPM. KE is a practice that emphasizes continuous improvement process. It emphasizes quality in every process and in parallel with the TPM goal (Chan *et al.*, 2005). Furthermore, the manufacturing industry also requires a continuous improvement process to complete their organizational performance. Therefore, many companies, including Procter and Gamble, Dupont, Ford and Eastman Chemical, have looked toward TPM. To augment their Just In Time (JIT) and Total Quality Management (TQM) programs in a drive KE practice. KE practice also affects directly and indirectly to the Innovation Performance (IP) because it emphasizes quality in every process improvement (Farris *et al.*, 2009).

The purpose of this study is to examine two things. This study focuses on (1) to identify the TPM constructs, KE constructs and IP measures for Malaysian automotive industry, (2) to develop research model of the TPM, KE and IP measures relationship for Malaysian automotive industry. This paper begins with a literature review that examines the current state of TPM, KE, and IP. An empirical research using structural equation modelling to test the proposed model follows. The final section presents the findings and discussion.

2. LITERATURE REVIEW

2.1 Total Productive Maintenance (TPM)

TPM was established in response to maintenance problems that occur in the factory. Therefore, the Japanese introduced and developed the concept of a systematic and effective maintenance that TPM. TPM adoption has increased significantly in Japan over the decades same with TQM. TPM is seen as an important pillar in the organization as well as TQM and JIT (Dale, 1994). Apart from that, according to Sharp and Kutuoguoglu (1997) showed that efficient maintenance will affect the company's profits through increased production, availability of plant.

The Japanese approach to TPM is promoted by the Japan Institute of Plant Maintenance (JIPM) and in particular advocated by the vice chairman of the JIPM, Siiechi Nakajima. Many devotees of the Japanese style TPM, such as Tajiri and Gotoh (1992) and Shirose (1992) regard Nakajima as the father of TPM and they recognise that a full definition contains the following four points:

1) It aims to obtain comprehensive efficiency.

2) It includes system encompassing maintenance prevention, preventive maintenance, improvement and maintenance related.
3) Involving all employee
4) Encourage the autonomous maintenance usage

Meanwhile, Nakajima (1988) summarize the TPM philosophy to be more simple and easy to understand. TPM is a productive maintenance involving all employees from top to bottom to create maximising equipment effectiveness through preventive maintenance. Hartmann (1992) and Willmott (1997) agree that TPM practices can be improve the productivity, quality cost, and operation technique, moral of employee and operation safety. TPM is designed to maximize the effectiveness of equipment and improve efficiency. By establishing a comprehensive productive-maintenance system covering the entire life of the equipment, spanning all equipment-related fields planning, use and maintenance (Tsuchiya, 1992).

TPM approach use the term "you operate, I maintain" because it shows the maintenance implementation in TPM involves cooperation between subordinates and superiors. It involves all parties in the continuous improvement of performance (Robert, 2002). TPM really concerned with the work as a team to eliminate the problem causes. It strives to achieve high quality, low cost improvements, an effective maintenance plan and also using the JIT procedures in the implementation (Eti*et al.*, 2004). Team work is through small group activities designed to zero in terms of breakdown and defect. Three components team work concept are:

i) To optimize the effectiveness of the equipment
ii) Handling ongoing maintenance
iii) Company-led small-group activities, throughout the entire organisation

Hence, TPM is also known as the approach of "high-employee involvement". It can have an impact on employees mind to be more creative, more effort and more motivated. In general, TPM starts from the top direction, implemented by the bottom, and was succeeded by the top management. It requires a high commitment from all employees facilitate this implementation (Shamsuddin*et al.*, 2005). Moreover, TPM is a manufacturing practice that emphasizes their actions and attitudes of employees to make improvement in maintenance, and manufacturer and maintenance employees also need to work together. In essence, TPM also use the individual potential in extensively to improve the productivity. Next, Table 1.0 below shows the constructs definition of TPM proposed by previous authors.

Table 1.0: Constructs definition of TPM proposed by previous authors

Constructs	Constructs Definition
Autonomous maintenance	Autonomous maintenance looks into the means for achieving a high degree of cleanliness, excellent lubrication and proper fastening (e.g. tightening of nuts on bolts in the system) in order to inhibit deterioration and prevent machine breakdown (Eti*et al.*, 2004). Autonomous maintenance activity, operators take care of machines by themselves without being ordered to (Ahuja and Khamba, 2008).
Planned maintenance	Planned maintenance investigates the underlying causes of equipment failure, identifies the root causes and implements matching solutions (Faber, 2009). Planned maintenance is a cross functional team activity (Borris, 2006).
Quality maintenance	Quality maintenance is to ensure that only the conforming product is manufactured to the customers' delight (Faber, 2009). Quality maintenance aims to prevent quality defects and it based on the concept that perfectly maintained equipment produces a perfect product (Venkatesh, 2007).
Education and training	The aim of education and training is to have multi-skilled and revitalized employees whose morale is high, who are eager to work and perform all the required functions effectively and independently (Faber, 2009).

2.2 Kaizen Event

Firstly, KE practice was been introduced and applied by Imai in 1986 to improve efficiency, productivity and competitiveness in Toyota (Ashmore, 2001). KE involves two concepts: Kai (change) and Zen (for the better) (Palmer, 2001). The term comes from KE meaning continuous improvement. The concept of KE has been receiving attention as a key to the success of global competition (Imai, 1986). After several decades, many studies focused on the manufacturing techniques in Japan, Total Production System (TPS), or lean production where it also involves KE practice (Aoki, 2008). In addition, KE practice accepted worldwide and has been practiced in many countries such as Europe (Oliver and Wilkinson, 1992; Elger and Smith, 2005), U.S. (Jayamaran, 1995) and Asia. It has also practiced in other industries other than manufacturing industries such as service industries (eg healthcare, hotel and etc.) (Bristow, 2009).

KE practice is one of the best basis practices and developed for help in terms of production. It is ideal for environmental today that highly emphasized on good productivity and there is innovation in each product or process. KE practices focused on a structured improvement project, using the approach of cross-functional team to improve and the target work area, with specific targets (Farris *et al*, 2009). KE practice also like TPM practice that primary the team work in making improvements. It involves all employees from the top to bottom. IIt calls for endless effort for improvement involving everyone in the organization.

Moreover, according to Deniels (1995) explains that to achieve fundamental improvements must start from the bottom to find out the real problem before making any decisions. Employees in the lower levels are more skilled to identify problems that are taking place and can measure it very well. Therefore, the KE practice is encouraged for used in automotive and manufacturing industries. Further, the Table 2.0 below shows construct in KE practices.

Table 2.0: Constructs definition of KE proposed by previous authors

Construct	Construct Definition
Follow-up Activities	Follow-up activity is the action that reflects the KE practice. It involves the work area employees to complete the action. Follow-up activities also give freedom to the employees to make any changes and innovation. But all the changes and innovations made by employees will be related to KE goals (Glover *et al.*, 2008).
Working area impact	KE activities affect the work area. Generally KE activities can help employees who are improving their work area (Doolen*et al.*, 2003). Moreover, Farris et al. (2008) states that the KE practice is a complex phenomenon organizational and has the potential to affect both systems, the technical system (work are performance) and social systems (participation employees and of work areas employees). Impact learning and stewardship when employees feel a shared of responsibility, freely share information, understand how their work fits into the experience and impacts experimentation when employee test new ideas to help themselves learn.
Employee Skill and Effort	Employee performance fundamentally depends on many factors like performance appraisals, employee motivation, employee satisfaction, compensation, training and development, job security, organizational structure and other. KE practice can improve the employee knowledge in

	managing an organization with more systematic and successful (Tanner and Roncarti, 1994; Butterworth, 2001). It also can be one of the platforms for knowledge employees in principles, tools and techniques for continuous improvement (Watson, 2002).

2.3 Innovation Performance

Innovation means the major process in improvement that involves the new processes, products and services (Sajeva*et al.*, 2005). Innovation is closely related to the amount of capital invested to develop new ideas and products. Innovation process can be divided into individual, group, organizational and social (Rogers, 1995). The innovativeness on new product and organization innovation capability is important to present opportunities for organization in terms of growth and expansion into new areas as well as to allow organization to gain competitive advantage. In general, the innovation will be advantageous to the organization with a combination of available resources with expertise, to directly compete at a higher level. It is seen as an organization's ability to combine various sources such as physical facilities, employee skills, tangible and intangible assets to improve organizational performance (O'Regan*et al.*, 2006; Teece*et al.*, 1997).

However, innovation does not just involve only technical innovation, it also includes the other innovation processes that use employee skill as a group and also involves a continuous improvement process (Armbruster*et al.*, 2005). Kanter (1984) has stressed that innovation is not only merely defined as technological innovation but also organizational learning and change processes in supporting and stimulating innovations. Recently, one major stream of innovation studies focus on human aspect that lead to innovation (Prajogo and Ahmed, 2006). Organizational IP measured through innovative activities conducted that impact the innovation environment. According Hinloopen (2003) innovation performance in Europe using a percentage of total turnover on the increased product as an indicator of organizational innovation measurement performance.

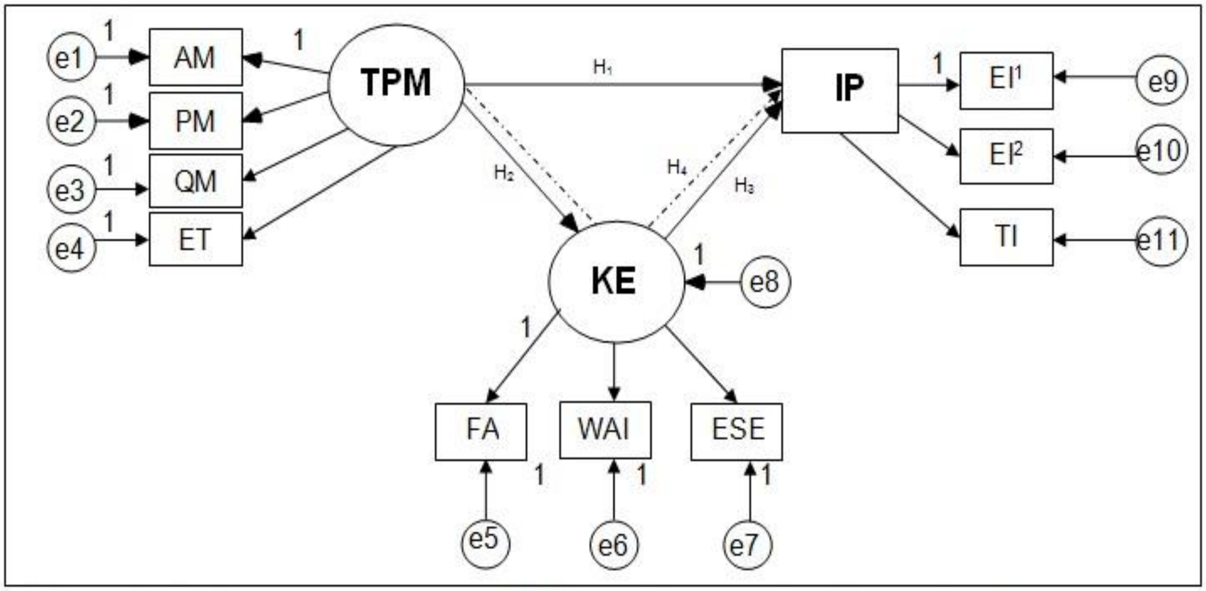
IP is also measured through employee involvement in the innovation process because of market competition makes organizations need to enhance the knowledge of its employees and can absorb the modernized rapidly developing technology. Based on internal organizational factors, innovation typically will involve the entire staff. Internal factors include knowledge, skills, physical, management systems and values and norm (Hung *et al.*, 2011).External factors for innovation practices include customers, competitors, countries and technologies.In other words, organizations need to advance in technology and must have talented employee to drive the organizational innovation process. Below is the table 3.0 which shows the performance measurement and related contents.

Table 3.0: Performance measurement of innovation

Performance measurement	Measurement content
Environmental innovation	Innovative activities and interaction (Hinloopen, 2003), environmental education and training (Hsu and Liu, 2010)
Employee innovation	Skill, ability and experience, employee satisfaction, employee initiative, employee commitment and cooperation (Hsu and Liu, 2010)
Technology innovation	Frequent introduction of new product ideas into production process, high probability of success for new products being tested, spending shorter periods in new product research and development, radical improvement in the company's technology, frequently renewal of equipment (Li *et al.*, 2006; Zahra *et al.*, 2000)

3. RESEARCH HYPOTHESIS

To more understand the relationship between TPM practices and KE practices and IP in Malaysia automotive industry, the following hypotheses will be used and tested. TPM practices and KE practices give many affect on an organization's management as management efficiency, equipment efficiency, reduced maintenance costs, innovation performance and others. Thus, these hypotheses have been developed based on the proposed conceptual model and previous studies.



*Note: TPM=Total Productive Maintenance, KE= Kaizen Event, IP=Innovation Performance, Autonomous Maintenance, PM=Planed Maintenance, QM=Quality Maintenance, ET=Education and Training, FA= Follow-up Activities, WAI=Working Area Impact, Employee Skill and Effort, EI^1=Environmental Innovation, EI^2=Employee Innovation, TI=Technology Innovation.

Figure 1: Proposed Conceptual Model

3.1 TPM positively influences IP

In general, based on previous studies, TPM will have an impact on organizational performance as the manufacturing performance, finance and environment. However, less research related to TPM practice relationship with innovation performance. There is a study conducted by Yamashina (1995) who showed that the implementation of TPM can give impact on IP of the organization. However, in the organizational performance are also have IP elements. So that it could indirectly linking TPM practices with IP. According Mckone*et al.* (2001), TPM practices can improve manufacturing performance because the maintenance activities can be planned well and effectively.

Meanwhile, the studies conducted in the food industry by Tsarouhas (2007) showed that the implementation of TPM practice can increase productivity, improve product quality and reduce production costs. Therefore, improvement in product quality could indirectly increase the IP of the organization to compete further at the global level. Similarly, Cooke (2000) in his study showed that the production and maintenance functions have a positive relationship. TPM practice implementation can improve the organization management efficiency in terms of quality production. McAdam and McGeough (2000) implemented TPM in a heavily demarcated and unionised organisation and reap the benefits.

Furthermore, Bamber*et al.* (1999) describes that one way to improve the maintenance performance for the overall is an effective maintenance practices such as TPM practice. TPM is an aggressive strategy focuses on actually improving the function and design of the production equipment (Swanson, 2001). Cooke (2000) also identified top management support, alignment of management initiatives and change, employee training, autonomy to employees and communication as important factors for the success of TPM in a European context. Ahuja and Khamba (2009), also describe in their study that the TPM practice implementation have significant impact on manufacturing performance. This study conducted in the manufacturing industry in India.

In addition, Gupta *et al.* (2003) conducted a study of the concept and implementation of TPM practice in an organization. The study found that the implementation of TPM practice can improve efficiency in the management of assets such as equipment and increasing productivity. Therefore, the increasing in productivity and quality of assets will affect the IP. It will involve the organization environment itself in fostering employee attitudes to volunteer improving innovation performance. It was also supported by a study conducted by Ncube (2006) in Colt Production facility that also uses TPM as a research material. It shows that the TPM practice will improve manufacturing performance if it is implemented consistently. For Colt Production facility, there are still some things that need to improve as the training of workers to ensure that the organization manufacturing performance run smoothly. It also could indirectly help to improve IP.

Hence, the pillar of TPM practice introduced by Nakajima (1988) as education and training, safety and quality maintenance will affect organizational performance (Ireland and Dale, 2001). TPM will be like a guide to conduct machinery maintenance work and other maintenance work. This case study is conducted in three companies, namely, Rubber Company, packaging company, and manufacturer motorised company vehicles. All this three companies have a different way to implementation of TPM practice, but the end of result will be an impact on organizational performance in various areas such as financial, manufacturing, and other innovations. Furthermore, it is supported by the study Chan *et al.* (2005) conducted in the electronics company who use the TPM in an organization's management practices. TPM practice provides benefits to workers and machinery used. It can help to increase employee knowledge in operation and machine maintenance. Machine productivity is also increased by 83%. Therefore, TPM can help organizations in various fields especially in the manufacturing and innovation.

Innovation is one of the most important factors to help organizations survive the global level. Innovation will certainly involve the maintenance and improvement both in terms of product, process or environment. The TPM practice implementation methodology provides organizations with a guide fundamentally transform their shop-floor by integrating culture, process, and technology. Combination of the culture, maintenance process and technology advances will indirectly lead to innovation performance (Wal and Lyynn, 2002). According to Yamashina (1995) TPM helps employees to begin design of new equipment for maintenance routine. In general, when it comes to new products, basically it will include innovations in the equipment or product. Each design is not always perfect and in need of maintenance and continuous improvement to enhance the efficiency of the equipment.

However, to implement the TPM practice is not easy, which is hindered by the burden of the organization, employee behaviour, culture, environment, and it requires a precise implementation to change the perception of other people from traditional maintenance approach to a more effective maintenance such as TPM practice (Gupta *et al.*, 2003). There are also organizations that fail to implement TPM and makes organization performance become worse (Graisa and Al-Habaibeh, 2011). This is because, innovation elements cannot be applied in the employee and his superiors. Implementation of TPM practice that are not clear and lack of training exposure will make the TPM practice cannot be fully implemented. Improvement in manufacturing process will bring to the innovation's element. Innovation in manufacturing will help organizations to striving achieve WCM. This statement supported by Yamashima (1995) in his research, shown that the excellence of its production capability and that those who conquer manufacturing will eventually conquer technical innovation. Therefore, based on previous studies, H_1 was proposed:

H_1: There is a positive and direct significant relationship between TPM implementation and Innovation performance in Malaysian automotive industry.

3.2. Integrated TPM Practice and KE Practice

TPM practice is a complement to other practices such as TQM, JIT and KE practice (Schonberger, 1999; Cua*et al.*, 2001). TPM element is helpful to other WCM practices. TPM shows how the maintenance of the equipment will give good effect to increase productivity. It relates to KE philosophy where the KE practice claims the machine or equipment operator to operate and maintain the machine that is always in good condition. This is because, management process that requires cooperation from the superior and subordinates to achieve manufacturing efficiency (Oliver, 2007).

In addition, the KE practice also involves the philosophy of Total Quality Control (TQC), which involves all employees in an organization. The main thrust of TQC is to improve the quality by optimistic and comprehensive management. Hence, TPM practice also involves a comprehensive quality improvement concern all maintenance aspects. For KE practice, this practices implemented more focused on reduce equipment damage, costs and improve quality (Oliver, 2007; Ventakesh, 2007). Indirectly, TPM practice and KE practice have a relationship through TQC aimed at almost the same in execution.

Indeed, it is supported by other several studies. Oliver (2007) implementation of TPM can be help to increase the KE practice. This is because, KE practice requires immediate and continuous efforts to make improvements and changes that the equipment used are in good condition. KE practice also strongly emphasizes the process than output, TPM practice can help the improvement process by do the ongoing maintenance and can give a good output. It is supported by previous studies Tood (1994) which explained that KE practice adopted for decades and would be better if supported by practices that have elements of the improvement.

Meanwhile, TPM practice also involves the measurement is Overall Equipment Effectiveness (OEE). Measurement is a critical requirement for the continuous improvement process. It can measure the extent to which improvements have been made to the equipment or product. OEE is a combination of maintenance operations, equipment management and available resources (Chan *et al.*, 2005). Some books are also pointed out that TPM also involves improvements in several case studies (Hartmann, 1992; Shimbum, 1995). For the study Kikuchi *et al.* (2007) aim at applying OEE method to cost reduction by using Kaizen technique to a semiconductor industry. As a result, the cost can be reduced quickly.

Chen and Wu (2004) explains that the KE practice can be produced through good improvement model and management support. In the TPM practice, management support is emphasized to create a good working team. Before making improvements, equipment problems should be known in advance. Therefore, this is where the TPM practice will be used to assist KE practice in order to reduce the maintenance cost. TPM will also increase the knowledge of employee through training provided, as well as the KE practice. Therefore, based on previous studies, H_2 was proposed:

> **H_2:** There is a positive and direct significant relationship between TPM implementation and Kaizen event in Malaysian automotive industry.

3.3 KE Practice Affected to IP

In the previous study, there are many companies who implement the KE practices in the management. Some company have succeeded in improving the quality, finance, management and innovation. However there are those who have failed in the execution because of the culture constraints and working environment (Faris*et al.*, 2008). KE practice indirectly affected organizational performance that have an impact on innovation performance because it involves changes to the equipment or product. Lee (2000) has been conducting research in the food manufacturing industry that KE practice implementation will improve working environment and motivate employees to achieve goals set by organizations such as increased innovation, finance and productivity.

Innovation involves a level thinking to think creatively and critically (Bessant*et al.,* 2001). Innovation and learning grow are closely related to the organization's environment because it will help the organization in order to survive in the market. Innovation will occur if the employee has the knowledge, desire and attitude to learn something new (Eker and Pala, 2008). In relation to that, KE practices have elements such as education, training, and knowledge. It is timely and relevant to the IP.

Furthermore, the KE philosophy is very important and can be applied in accordance with environmental culture, especially in the manufacturing industry. Many researchers through their case studies show that KE practice give benefit the organization, such as improving productivity and quality, reduce costs, improve safety and expedite the delivery (Powell, 1999). Improvements in productivity and quality will indirectly improve the quality of innovation because innovation concerned. Similarly, Terziovski (2001) who investigate the relationship the KE practice with innovation to Small Medium Enterprise (SME) performance in 115 Australian manufacturing industries. The finding result shows the practice has a significant correlation KE practice and innovation in SME.

Besides that, KE practice can be used as the prime movers to innovation practice (Ahmed *et al.*, 2005). KE practices as an indicator showing effective to create an innovative environment. Implemented process by the KE practice is for foster mind of employee as well as makes improvements to reduce production costs. Likewise with Soderquist (1996) who has done research on KE practice and innovative practices in the French SMEs. It found that the implementation of KE is seen as an important practice for improving innovation practices in French SME. Sources of innovation starts from KE work process and changes made by the employee.

However, Imai (1997) give different views on the implementation of the KE practices and IP practices. KE is a small improvement activities carried out continuously by employees. While innovation is simply a drastic change and involve new investment for get new resources such as technology and new equipment. Therefore, the KE practice and innovation are two different things and not interconnected with each other. Based on previous studies, many studies show that KE practice have a positive impact on IP. Thus H_3 was proposed:

H_3: There is a positive and direct significant relationship between Kaizen Event and innovation performance in Malaysian automotive industry.

3.4 The Integrated between TPM, KE and IP

Many studies have shown that the TPM will have an impact on overall organizational performance (Robert, 2002; Eti*et al*., 2004; Ahuja and Khamba, 2008, Ahuja*et al*., 2008). TPM is a relationship synergistic relationship among all organisational functions, particularly between production and maintenance. This aims for continuous improvement of product quality, as well as operational efficiency and capacity assurance. No studies have linked TPM and KE effect to IP. However, based on the literature review for the first until the third hypothesis, generally TPM and KE give indirect impact on the IP. But in the McAdam and Armstrong (2001) study shows that the senior management involvement and employees are critical factor in organizational innovation. This condition was associated with TPM and KE philosophy that emphasizes the involvement of the whole organization.

Furthermore, for KE practice, this practice is greatly contributed to the improvement in quality, productivity, reduce costs thereby improving organizational IP (Terziovski and Sohal, 2000). Hence, research by Farris *et al.* (2008) and Anh*et al.* (2011) showed that KE practice can improve organizational performance and affect employee motivation to innovate on the output (Laraia*et al*., 1999). Even so, there are also studies that indicate that the management system has a negative relationship with IP (Tidd*et al*., 1997). Management system more related to TQM than TPM. TPM practice and KE practice implementation will fail if the top management does not know the proper way to implement it. Therefore it will affect IP. Based on this statement, H4 was proposed:

H_4: The impact of TPM implementation on innovation performance increases with a mediating of Kaizen event in Malaysian Automotive industry.

4. METHODOLOGY

In this study, sampling method by using structured questionnaire. Then, the population for this study consisted of suppliers in the automotive industry in Malaysia. Questionnaires will distribute to respondents from the listing of automotive industry obtained from Malaysian Automotive Component Parts Association (MACPMA), Proton Vendors Association (PVA), and Kelab Vendor Perodua. To analyze the data, one statistical technique was adopted. Structural equation modelling techniques was utilize to perform the require statistical analysis of the data from the survey.

Exploratory factor analysis, reliability analysis and confirmatory factor analysis to test for construct validity, reliability, and measurements loading were performed. Having analyzed the measurement model, the structural model was then tested and confirmed. The statistical Package for the Social Sciences (SPSS) version 17 was used to analyze the preliminary data and provide descriptive analyses about thesis sample such as means, standard deviations, and frequencies. Structural Equation Modelling (SEM using AMOS 6.0) will use to test the measurement model.

This study is expected to arrive at the following conclusion: This study has important implication for TPM, KE and IP in Malaysian automotive industry. As such, it is expected to benefit both researchers and practitioners.

5. DISCUSSION AND CONCLUSION

Therefore, briefly this study will be beneficial and useful to many parties such as the academic and industry, particularly the automotive and manufacturing industry in Malaysia. It can be used as a benchmark for implementing TPM and KE practice effectively in the future. The barriers and risks to implementing these practices can be known in advance when using the findings of this study. A conceptual model was proposed to study the relationship between TPM, KE with IP in automotive industry in Malaysia. Based on proposed model and a previous study, research hypotheses are being developed. The next step of this study is to design a questionnaire, which will be used for pilot study data collection in automotive industry in Malaysia

6. ACKNOWLEDGEMENTS

The researchers would like to acknowledge the Ministry of Higher Education (MOHE) for the financial funding of this research thought Fundamental Research Grant Scheme (FRGS), and Research Management Centre (RMC) UPSI for Research University Grant (RUG).

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